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BRANCH OF RESEARCH

December, 1934.

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ALLEGHENY FOREST EXPERIMENT STATION

General

In spite of last minute opposition from the town of Sheffield, Pennsylvania, which objected to any Government action which might curtail the life of its sawmills, the purchase of Tionesta Forest was approved by the National Forest Reservation Commission on November 23. Approximately 3500 acres of virgin hemlock and northern hardwoods, the largest area of virgin timber between the Adirondacks and the Great Smokies, passed into Federal hands. The purchase probably evoked more publicity in our territory and New York City than any previous item concerning the Station, and the annual meeting of the Pennsylvania Forestry Association will be devoted to a discussion of it. Regional Forester Evans and his associates visited the tract under the guidance of Hough, Forbes having been prevented from joining the party by illness, and a plan of fire protection was formulated. The Region is in no hurry to draw up a plan for the administration of the area, and Hough is working on a detailed proposal for the establishment of a natural area. The Office of Forest Entomology assured Hough that no method of slash disposal in the adjacent cutting of virgin timber is likely to reduce the damage to hemlock from insects. This office believes that the insects which have been found abundantly in dead and dying hemlock in Tionesta are entirely secondary in character, and will not attack healthy trees.

C.C.C. labor on the Kane Experimental Forest has been used in road repair, maintenance of buildings, and the construction of several deer and rodent-proof exclosures.

Weather records at Camp Ockanickon, kept for the past four years, have been discontinued, and the accumulated data are being analyzed for several purposes, mainly in connection with the plantation report. In return for being allowed to use the newly constructed laboratory at the Lebanon Branch Station as a residence during the winter, a C. C. C. member is keeping the newly-begun weather records at that point.

Our new greenhouse on the campus of the University of Pennsylvania is being very fully used already by our B. P. I. collaborators, although the constructing company has not yet fully completed its job.

In connection with the Nira estimates for December 10 we have been analyzing the data on the oak type in Pennsylvania, collected by the Department of Forests and Waters for the Land Planning Report

and published in the Department News Letter. This analysis has been one of the factors determining our choice of two locations in the oak type for proposed branch stations: the anthracite coal region, and central Pennsylvania. A branch in the anthracite region, which presents some of the most acute problems of forest rehabilitation in our territory, is particularly justified in connection with the designation of the Delaware watershed as fourth among all the watersheds of the United States deserving Federal aid in its management. Unfortunately, there is practically no state forest land in the region, and Federal purchase of an experimental forest through Region 7 seems to be about our only hope for the establishment of a branch. In central Pennsylvania, on the other hand, the Agricultural Adjustment Administration is contemplating the purchase of a tract of sub-marginal farm land, and the local Administrator has informally indicated his willingness to see a part of this tract turned over to the Station. The bulk of the tract is desired by the Pennsylvania State College for the purposes of instruction and research. During a recent visit to State College Schnur found Dean Watts favorably inclined to cooperation, and coordination of our research programs at that point.

Requests for information from members of our Advisory Council resulted in our compilation of data on the cubic volume of large trees in the United States, and a summary of the available information on the effect of soil quality on rate of decay in hardwoods.

Through the Serb we have obtained the services of two stenographers, two computing clerks, and a draftsman. This brings the Station staff, including Pathology, to 22 people.

Management - Allegheny hardwoods

Work on the material obtained from the ten plots established in Tionesta Forest last summer has occupied three men under Hough's direction. The vitally important plot descriptions have been put in final shape, maps of seven of the ten plots have been completed and traced, and ring counts have been made of all of the larger hemlock sections and a very satisfactory number of the smaller sections of all species. Hough and Niederhof have, we believe, nearly solved the extremely difficult problem of counting the rings of small suppressed hardwoods, particularly beech. These specimens of which we have literally thousands, are first sanded on a sanding machine, then given a rough polish on a fine emery wheel, and finally given a high polish on a buffer. A half-horse-power electric motor has been harnessed to the necessary machinery, on a workbench in the basement. After receiving the three successive treatments, the sections present a beautifully polished surface on which the rings are quite easily discernible with a binocular, low-power microscope. The proportion of sections on

which further work, such as staining or the cutting of thin sections, is necessary, is quite small.

The Pennsylvania State College has undertaken to analyze some 30 soil samples obtained by Hough on the Tionesta plots. The samples were obtained from the soil pits, and the various horizons will of course be analyzed separately. Both mechanical and chemical analyses will be made, and the attempt renewed to find some correlation between soil types and vegetation. Hough's previous efforts to obtain such a correlation from the soil map especially made by State College for part of the Tionesta area have not yielded promising results to date, although the analysis is not yet complete. If the soil types recognized by the Soil Survey have no discernible relation to the forest vegetation in virgin areas, it seems to us that they can hardly prove useful in cut-over areas and second growth.

The permanent yield plots in oak at Camp Ockanickon were remeasured by Schnur, Wood, and two assistants at the end of the first five-year period. Some of the 14 plots were located on a "safety strip", from which all dead trees were removed and the brush mowed off and burned in place.

Growth on this strip appears to have been less than on adjacent strips, where the trees continued in competition with heavy underbrush. Whether this effect is due to injury by the fire when the brush piles were burned, or to desiccation resulting from the removal of the low vegetation, remains to be seen. The tree numbers put on in 1929, at the time of establishment, with rubber stamps using ordinary white (lead) paint in a thick paste-like form, were almost obliterated by weathering. The outlines of the numerals were fairly distinct in some cases because a slight ridge of paint was formed by the pressure of the stamp against the bark. This was squeezed out from under the flat face of the stamp. It is believed that hollow-faced stamps would leave more paint on the face of the numeral thereby lengthening the time of legibility. The numbers were repainted by hand several days before remeasurement which greatly facilitated consecutive location.

Mensuration - Coastal Plain

Simmons has completed the first draft of a very promising paper on the effect of thinning loblolly pine on the Eastern Shore of Maryland. Although five remeasurements of these plots have provided unique data, only a few of the plots were thinned, and without much variation in methods. He found that regressions between basal area and future growth were very similar both for thinned plots and for natural stands of varying degrees of density. Since a greater range in density was available in natural

stands than in stands having varying degrees of thinning, all plots were thrown together for the density and basal area-growth correlations. Both mortality and growth can be predicted with a fair degree of accuracy from either density or basal area present. Up to this point Simmons was using basal area as a measure of growth, but is now working with volume.

Special Studies

The drought study analyses have been completed. Softwood species were generally hit the hardest, in several cases 100 percent being lost. Year-by-year correlations between precipitation and radial growth in percentages of 20-year averages on several hundred cores, obtained by McIntyre, showed great irregularity.

APPALACHIAN FOREST EXPERIMENT STATION

General

The addition of 1600 acres to the Toccoa Experimental Forest is proposed. This is made up of lands in the watershed which have been recently acquired or are under option and their addition will place the entire Mulky Creek watershed in the experimental forest. The new boundaries have been roughly blazed in the field.

Dr. R. M. Gorrie visited the Station, going over the stream-flow and erosion installations in particular and the work of the Station in general. While here he showed moving pictures of forestry in India and described the work of the British Forest Service there.

Frothingham and MacKinney attended the meeting of the Southern Research Council at Lake City, Florida, and the supervisors' meeting at Atlanta, Georgia, where Frothingham addressed the meeting on the coordination of research and national forest work. They also visited the Pulp and Paper Laboratory at Savannah, Georgia.

Management - Mountains

A decrease in the height growth of released yellow poplar and an increase in the height growth of check trees of the same species at the end of the first growing season after treatment was found on Plot 2, Stony Fork, North Carolina, by C. A. Abell. Practically no mortality was found. This plot is located in an area in the transition type between cove hardwoods and northern hardwoods which was clear cut with seed trees 6 years before the cleaning was made. The study area is divided into 32 subplots with 4 replications of checks and of each of 7 different treatments. Spacings of 11 x 11 feet, 16-1/2 x 16-1/2 feet, and 22 x 22 feet were used with light and heavy release for each spacing. In light release the surrounding vegetation 1-1/2 feet from the edge of the crown and, above the top of the tree, 3 feet from the vertical projection of the crown, was cut or girdled. Complete release, the seventh treatment, consisted of heavy release of all desirable trees.

The trees from these subplots were grouped into check, heavy release, light release, and complete release, the 3 spacings being disregarded since it was believed they would have little effect

the first year. Yellow poplar was the only species considered since it contained the most trees. No significant difference in height growth was found between any of the groups considered although the height growth for the check trees was above that for any treatment.

However, when actual difference between 1933 and 1934 height growth was considered the following values were found:

Treatment	Difference between 1933 and 1934 growth (1934-1933) feet	
Check	+ .20	+ .06
Complete	- .34	± .04
Heavy	- .35	± .05
Light	- .22	± .05

The increase in the height growth of the check trees is attributed to better climatic conditions in 1934 and to the natural height growth-age curve. The height growth the first year following release was actually decreased by the treatment, that of the trees in the heavy and complete release more than those in the plots receiving light treatment.

It is believed that the rate of height growth of the released trees will increase in the next two years until the released trees will be taller than the checks. Further measurements are planned to determine whether increase in diameter growth or branch formation accompanied the decrease in height growth the first year.

The value of the measurement of growth the year before treatment is evident. These measurements made it possible to find significant differences when they could not be found without them. It is suggested that the last two years height growth be measured wherever possible on similar plots in young stands. Some error may be introduced in cases where a tree has died back. However, careful examination of the tree at time of measurement will disclose this in most cases.

On the release plots in north Georgia practically no difference was found in the first year following liberation between the height growth of white pine released and those not released. The second year after treatment the average height growth of released trees exceeded that of the check trees in the same original height classes, although the difference was found not to be significant as yet. On these five quarter-acre plots, 2 of which are checks,

all of the hardwood overstory above the 3 inch d.b.h. class was deadened. The released pine, both white and shortleaf, ranged in age from 1 to 15 years and varied in height from 1 foot to 20 feet, the greatest number being under 1 foot in height.

Mortality was confined entirely to trees below 1 foot in height, the values for the first year after release being from 8 to 12 per cent for trees 0 - .24 feet in height and 0 - 7 per cent for trees .25 - .49 feet, with mortality about 1 per cent for trees .50 - .99. Mortality the second year was about half what it was the first year. When all of the white pine are considered mortality varied from 3 to 5 per cent the first year and from 1 to 3 per cent the second year.

Streamflow and erosion

A reconnaissance of soil and land conditions within the Piedmont area of South Carolina was made by Plice and Blake Creasman to determine problems pertaining to streamflow and erosion on abandoned land that will come under national forest supervision through acquisition within the Enoree and Long Cane National Forest purchase units. Results of this survey will be used to orient research problems in streamflow and erosion.

The greater portion of the land in both of these units has at one time been cleared of the original hardwood forest. New growth where it is found is almost entirely of softwoods. Abandoned fields are restocking naturally only under favorable circumstances. Special treatment is necessary to obtain establishment of a new vegetative cover on many of the barren areas.

Over most of the area, the constant cultivation has led to the development of a plow depth containing very little organic material. Below plow depth the soil horizon is less favorable to rapid percolation. Both of these conditions contribute to relatively rapid stormflow developing serious erosion and flood conditions. Observations of the soil profiles indicate that where tree cover has become reestablished, soil porosity is improved and, consequently, percolation. Apparently, this improved condition of the soil structure is due to the deep tap roots developed by the growing trees penetrating the heavier textured soil horizons.

Koulichkov, aided by Loughead, has developed and built a device for securing from flowing streams water samples for silt determinations. This sampler is similar to those generally used. However, it is more precise and better adapted for use on small streams. With this instrument it is possible to secure a sample of the complete stream profile or a sample of any portion of the profile. Probably the major improvement is in the shape. The

chief objection to the cylindrical type sampler commonly used is its inability to procure a true sample at all depths. To eliminate this error, the new instrument is rectangular in shape, thus assuring a true sample even on the stream bed.

Detailed description and diagrams are available at this Station.

Fire Damage

The Station and Pierce of the Weather Bureau are cooperating on a study of fuel moisture and inflammability. Preliminary work in the determination of a standard fire brand and a satisfactory method for measuring the moisture content of hardwood litter has been started.

Fire Weather

The season of forecasting was terminated December 11. Serious fire hazard was confined almost entirely to the month of November which ended with generous rains on the last few days, followed by low temperatures during the first two weeks of December which maintained fuel moisture above the danger point.

CALIFORNIA FOREST EXPERIMENT STATION

Range Research

Forage Growth

When does new feed come on California foothill ranges? No wonder stockmen find it difficult to plan in advance of each season! For example, on December 1, following good rains and relatively moderate temperatures, the whole foothill region was green and new forage growth was starting with a rush. Only slight differences in growth were observed between elevations of 250 and 2500 feet. On ungrazed ranges grasses averaged 2-1/2 inches in height, and herbs 1-1/2 inches in spots which have had partial protection for a period of years heights of 5 or 6 inches, and occasionally 10 inches, were recorded for grasses. Corresponding stages of growth were not reached until 14 weeks later, in 1933 -- certainly a great variation between successive seasons.

Noteworthy are the striking differences in forage composition, as observed in three plots, following two years of different treatment, as follows:

Plot No.	Treatment	Grasses		Herbs	
		1933	1934	1933	1934
1	Grazed by livestock	1	5	99	95
2	Protected from livestock	9	70	91	30
3	Protected from livestock and rodents	1	80	99	20

A New Device

A simple soil-grooving tool which greatly facilitates the setting of "side boards" on runoff-and-erosion plots, with the minimum disturbance of adjoining soil, has been developed by Magee. Copies of the diagram and specifications will be furnished, on request, to any station planning the installation of additional erosion plots.

Obituary

In the sudden death, on December 23, of Thos. F. Tavernetti, Assistant Dean of the College of Agriculture, University of California, the Station lost a real official and personal friend. He was especially close to our range-management work; was keenly interested in the San Joaquin Experimental Range which he had enthusiastically supported; and, on the eve of his sudden illness, had been working out the details of University cooperation on certain phases of this project.

Forest Survey - Cover Type Map

Progress

During the 6-months' field season, from June through November, an average of seven 2-man crews mapped an area of approximately 3,250,000 acres, principally within the Plumas, Tahoe, Eldorado and Mono National Forests. Office work meanwhile was completed for an area of approximately 2,750,000 acres, a large part of which, however, had been mapped previous to June 1.

With the aid of SERA workers rapid strides are being made in bringing the herbarium work up to date. Our collection now numbers about 7,000 sheets; about 1,000 sheets having been added during the past month. In addition to the actual mounting work, a card index system is maintained so that lists of species with all pertinent data, for each quadrangle area, are immediately available.

Fire Research

Fire Control Planning

December saw plans well launched for active work in transportation-planning projects in the four southern forests of the Region. Since these forests represent a complex fire-control problem which is probably not duplicated elsewhere in the United States, a complete new approach is contemplated.

Since the development of the transportation plan of these forests is so intimately related to the whole protection problem, the treatment of road systems in a plan-wise fashion must be preceded by study of greater scope in which standards must be defined in all phases of fire control effort. The very high values at stake will be used as a major control element. Four broad valuation classes have been set up and have been defined as far as possible on each forest by means of a conference held in Los Angeles. Within territory in each of these value classes the inflammability of the cover and the degree of risk will dictate the

prescription to be used in the way of fire-control provisions. These three factors, values at stake, inflammability, and risk, are each sufficiently important to dominate fire-control plans in certain areas. Consequently, they will be recognized throughout the planning procedure. For each significant variation of these three factors, a model set of fire-control provisions has been developed.

The intensive cover-type survey, which has been completed in this part of the State by Wieslander, has already made available the detailed information necessary for an accurate classification of hazard. The risk data are available through the preliminary work that was done in the detection-planning project. The attempt, then, in carrying this whole project forward will be to consider, as a problem in itself, each logical unit of the forest that carries a uniform proportion of the three control factors. The standards to be met will be applied by these individual units, and the whole coordinated to meet practical limitations. In general, values at stake will control the amount of investment in permanent improvements. Inflammability of cover will dictate the necessary speed and strength of attack in fire suppression and will control the technique to be applied. The degree of risk will, in general, influence only the permanent man-power that will be maintained on the ground. To this degree it will, in some instances, dictate some sacrifice of speed which must be compensated for by increasing the strength of attack or by making more provision for fire-breaks.

Fire Behavior

Sixty pine-needle fires were started in the fire laboratory to determine the effect of slope upon the rate of spread of fires. The tests were conducted on a table nine feet long and four feet wide, whose longitudinal slope could be varied from 0° to 55° . The perimeters of the fires were plotted on polar coordinate paper at one-minute intervals. It was found necessary to break the needles up into short lengths to decrease the rate of spread sufficiently to permit of accurate recording.

Analysis of the data failed to give satisfactory results in terms of actual rate of spread expressed in feet per minute. The wide variations between different fires were attributed to some variation in the moisture content of the needles burned in different fires, and to the failure to get an absolutely similar distribution of needles for all fires. A much larger number of fires will be required to determine with any accuracy the effect of slope upon actual rate of spread in terms of perimeter or maximum radius.

The ratio between spread up and down the slope, however, was established quite definitely - regardless of the actual linear spread in feet. This ratio was found to vary from 1/1 at 0% to

2/1 at 50% for six minutes, the maximum length of the fires. This ratio is very nearly in proportion to the sine of the slope angle.

From the 1934 test-fire data, ratios between fore-and-aft linear spread were computed for those fires with zero slope and constant wind direction. The effect of wind upon the ratio of linear spread (with the wind and against it) was definitely established as varying from 1/1 with no wind to 6/1 with a 5.5 m.p.h. wind, the maximum recorded over a two-minute period. The effect of time seems to be negligible after the first four minutes.

A group of test fires on slopes was then selected in which the wind direction was constant and coincided with the exposure of the slope. The ratios between linear spread up and down the slope were then computed to show the combined effect of wind and slope. A ratio between fore-and-aft linear spread as high as 20/1 are indicated for a 4.5 m.p.h. wind blowing up a 23% slope.

Forest Products

Logging and Milling Studies

Compilation and analysis of the new east-slope pine study is going forward rapidly with the assistance of several SERA part-time office workers under Tebble's supervision. If this outside help continues to be available for another two months, the entire job, including a depreciation study of the lumber from the whole run of study logs, about 500 M.B.M., will be completed except for miscellaneous analyses not essential to the main issue.

On the basis of this and the Stanislaus studies, Brundage has prepared a new set of log-grading rules to give greater accuracy in reconstructing tree values and to eliminate a major share of the pure guesswork which is the predominant feature of present log-grading. The rules are based entirely on visible and measurable characteristics coordinated with log diameter, length, or both. Few size limits have been prescribed yet, but may be after actual application in a future study. There may also be some changes in the line of demarcation between each successive grade. The new rules for pine follow in outline form:

Grade 1. Select logs. Must be very smooth in appearance with no knots or indications of knots near the surface in logs up to 36 inches d.i.b. Logs over 36 inches d.i.b. may have one knot in any location, one knot in any location and one knot within 1 foot of either end, or, when there are no central knots, two knots will be allowed within 2 feet of either end (i.e., two knots at one end, or one knot at one end and one at the other end). Grade 1 logs with knots must be exceptionally perfect in surface appearance otherwise.

Grade 1 Shop. (a) Must be 20 inches or larger in d.i.b. and may have any number of knots along one side provided they are confined entirely within a longitudinal area (boundaries parallel to the axis) whose width does not exceed 25 per cent of the circumference at the small end. The 75 per cent or more of clear area must be high-line Grade-1 in surface appearance; or, (b) logs 20 inches d.i.b. or larger with scattered knots not exceeding in number the first digit of the diameter (2-digit numbers expressed in inches) for 10-foot lengths. For each 4-foot increase in length above 10 feet, one extra knot is allowable. Otherwise the log must be Grade-1 in appearance and free from spiral or cross grain exceeding a slope of 1 in 10.

Grade 2 Shop. (a) Same as #1 Shop except knots must be confined to longitudinal area exceeding 25 per cent but not exceeding 50 per cent of the circumference at the small end; or (b) 2 times the scattered knot allowance for Grade 1 Shop logs. Clear areas between knots must be straight grained and perfect, as for Grade 1 Shop.

Examples of Grade 1 and 2 Shop logs:

	Limit, number of scattered knots	Grade 1 Shop	Grade 2 Shop
20 to 29 inches x 10 to 12 feet	2	4	
20 to 29 inches x 14 to 16 feet	3		6
30 to 39 inches x 14 to 16 feet	4		8
40 to 49 inches x 10 to 12 feet	4		8

Grade 3. High class Common logs. Logs with too many knots to qualify as Shop logs.

D.i.b. 6 to 20 inches, inclusive. 90 per cent of all knots must be intergrown and not larger at the surface of the log than 1/6 of the small-end d.i.b.

D.i.b. 21 inches and over. 75 per cent of all knots must be intergrown and not larger than 3-1/2 inches.

Grade 4. All logs failing to meet the specifications for other grades, except as follows

Logs almost good enough for Grade 1 but too rough or "bumpy" in surface appearance to qualify as smooth should be placed in Grade 1 Shop.

Logs meeting the specifications for Grade 1 Shop as to knots but disqualified because of grain should be placed in Grade 2 Shop.

CENTRAL STATES FOREST EXPERIMENT STATION

Experimental Areas:

Early in December Day inspected the buildings being constructed by the State Foresters of Ohio and Indiana on the two State Forest experimental areas which they have turned over to the Station. The attractive headquarters building on the Morgan-Monroe tract in Indiana is rapidly approaching completion. It is constructed largely of oak cut within the State Forest, and is finished inside entirely with oak panels. It is wired for electricity, and is equipped with an inside toilet and shower bath. The building on the Shawnee forest in Ohio is being constructed of chestnut logs, and at the present time approximately four courses of logs have been laid. An outside well with satisfactory water has been dug. Both buildings will have good-sized stone fireplaces, and two-car garages are being built on each site.

Following up the cooperative project on Alexander Thomson's "Old Timbers" estate in southern Indiana, Kellogg has prepared a topographic map from data secured by Cochran in November, and Chapman has completed a type map of the same area. From the field data collected he has been able to show wooded areas, plantations, restocking areas and abandoned fields.

Cooperation with Lumber Code Authorities:

Day attended a conference at the Purdue Agricultural Experiment Station, at which an interesting experiment and demonstration in attaining sustained yield was proposed. The difficulties of accomplishing much under Article X within the North Central Hardwood Subdivision, are well recognized, since most of the forest lands are not owned by the timber operators. Ownership is scattered among thousands of individuals, most of whom are farmers.

The Regional Office at Milwaukee, which is heading up the public cooperation in the Code work of this region, has, consequently, come to the conclusion that the most effective work which it can do toward sustained yield is through education of the individual owners in the advantages of sustained yield management.

The conference held in Purdue, therefore, represents the first step in the development of what may become a series of demonstrations in sustained yield management. Representatives of the Purdue Agricultural Experiment Station, the Indiana Division of Forestry, the Regional Office at Milwaukee, and the Central States Forest Experiment Station discussed the feasibility of the experiment

and attempted to select an area within the state which would be suitable. Two committees were appointed, one for the purpose of making a final selection of the area, and the other to draw up detailed plans for the initiation of the study and a tentative working plan for sustained yield management within the area. A second meeting of these two committees has been called for January 3.

Since this project will be largely a demonstration, the responsibility for its success will fall to the Extension Services of the University and to the Office of Public Relations at Milwaukee. The contribution of the Station will be limited to the collection of growth data, a certain amount of technical supervision in the preliminary field work, and to cooperation in the development of the plan of work. Present plans, subject to the approval at the conference on January 3, contemplate the establishment of a small working circle in the vicinity of Dubois County, Indiana. A field cruise will be made to determine the volume of merchantable timber within the unit, and preliminary growth and yield studies will afford a rough prediction of annual cut. With these data at hand, the mill operators and the timber owners will be contacted and joint agreements secured, which will permit the marketing of the maximum annual cut.

Since the area tentatively selected for this experiment lies on the borderline between the farmwoods and the upland hardwood forest, it is expected that both Kuenzel and Diller will contribute to the growth and yield studies which this Station has agreed to make..

Forest Management

Farm Woods:

Day and Diller, together with DenUyl of the Purdue Agriculture Experiment Station, have made tentative plans for the first five-year remeasurement of the thirty permanent plots of the woodland grazing study. Annual remeasurements have been made on a number of these plots for reproduction studies, but this will be the first opportunity to determine relative growth rates for mature timber in grazed and ungrazed stands.

DenUyl, with the aid of a number of F.E.R.A students, is completing an analysis of the data collected last summer on a number of farmwoods in central Indiana. Stand and stock tables have been built up for several of the finest farmwoods to be found in the state.

DenUyl is also analyzing a study made by Diller and Marshall for the purpose of determining statistically what percentage of cruise is necessary to secure a representative sample of extremely variable conditions in the farmwoods. This work has not been completed, but indications are that at least a twenty per cent cruise will be necessary for all farm woodland management studies which may require an inventory of the timber.

Remeasurement of Cutting Plots:

The early part of December was spent by Kuenzel in completing the five-year remeasurement of the 1929 Mill Tract partially cut plots on the Clark County State Forest at Henryville, Indiana. Summary tables showing the increase in growth by species for each forest type were prepared in the field. The reproduction over 1.0" D.B.H. was tallied on 10 mill-acre quadrats through each tenth acre plot. Borings were made in all the crown classes for each tree species to determine the influence, if any, of the 1929 and 1930 cutting operations on the rate of growth.

A persimmon tree of record size was photographed by Kuenzel. The tree stands in an old field 4-1/2 miles west of Henryville, Clark County, Indiana. A diameter of 31 inches at breast height, and a total height of 91 feet were recorded for this persimmon. The tree was laden with a heavy crop of fruit, some of which were collected for planting on the station's experimental areas.

A large number of aluminum tree tags bearing numbers were found destroyed or severly chewed on the mill tract plots in Clark County, Indiana. The destruction of these tags by rodents has been noted by other members of this and other stations. As nearly as can be determined, this gnawing was done by red squirrels. Identification was made by comparing the distinct teeth marks left on the aluminum tags with the dentition of the red squirrels mounted in the museum at Ohio State University. The comparison was made with the assistance of Dr. J. W. Price of the Zoology Department.

Forest Plantations

Kellogg conferred with Prof. Alex Laurie of the Department of Floriculture to initiate cooperative nursery investigations at Ohio State University. It is planned to produce locust and shortleaf pine stock for experimental use.

Chapman spent a part of his time on the report of the plantation survey made last summer throughout the unglaciated portion of the Station's territory. He also has compiled information, partly from his survey and partly from available published sources, dealing with the production of shortleaf pine planting stock.

Five volume tables of plantation black walnut, prepared by Kellogg, have been mimeographed and distributed as Station Notes 17-21, inclusive. These tables give total cubic foot contents, merchantable contents in cubic feet, board foot contents by International Rule to a 5" top, board foot contents by Scribner Rule to an 8" top, and board foot contents by Scribner Rule to a 10" top.

Forest Soils

During December Auten made an interesting soil study in a yellow poplar plantation in southern Ohio, the results of which were similar to his findings in the former study of walnut and locust plantation soils. It affords an excellent example of the influence of soil and site upon tree growth, and the difficulty of predicting the success of a plantation without complete knowledge of the site conditions.

This poplar plantation showed extreme variations in growth of trees within a relatively small area. In one place the trees averaged from 4 to 6 inches in diameter, whereas within a distance of 40 paces no tree was over 2 inches in diameter. Height growth showed similar variation.

A superficial examination indicated little difference in site as far as surface soil, slope, aspect, or exposure were concerned, but a study of the soil profiles clearly indicated important factors not apparent on the surface. On the area of good tree growth the entire profile down to the parent sandy shale four feet below the surface was comparatively loose and well aerated. On the area of poor growth the subsoil was much heavier, and in one instance was composed of very tight clay. On the better area the surface organic horizon was from 8 to 12 inches in depth, while on the poorer site it varied from 4 to 6 inches. Chemical analyses of the respective horizons showed small and probably insignificant differences in the per cent of nitrogen content of these two sites. The combination of upper horizon and tight subsoil apparently made the difference between failure and success as far as the growth of yellow poplar was concerned. This affords a good example of the factors to be determined on sites proposed for planting if failures are to be avoided.

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Forest Management

Recent work has been confined largely to compilation and preparation of reports. Data on stand improvement methods and technique have been compiled and a report is ready for distribution to the field recommending suitable practices in the ponderosa pine types. The preliminary results of the planting project initiated in 1934 have been summarized. This project included a series of planting plots representing different sites in the ponderosa pine type. First year survival ranged from practically zero on exposed south slopes to 60 per cent in creek bottoms. Other work on the compilation of timber surveys on the experimental forest and cut-over areas in Region 4 is progressing rapidly.

The compendium of logging output information for use in selective logging cost analysis in the Intermountain region is nearing completion. In general the resulting report is satisfactory even though lack of information precludes a complete report covering all conditions encountered in this region. Only a limited amount of field work will be necessary to fill the existing gaps.

Further studies were initiated during December to determine the effect of methods-of-cutting ponderosa pine on the storage and melting of snow. Two snow survey courses were established representing conditions on virgin timberland, national forest cut-over land ~~private cut over land~~, second-growth timberland, and open ~~grassland~~ grassland. The water content of the snow at each of the 340 stations on these two courses is to be measured twice a month throughout the winter and at more frequent intervals during the spring melting period. The results from the various points of measurement will be segregated and compiled by groups with common features such as aspect, slope and timber type.

Range Management

Effect of Burning on Grasses in Sagebrush-Wheatgrass Type

Fifty-eight quadrats on sagebrush-wheatgrass range on the Snake River Plains in Fremont County, Idaho were established and mapped in 1932. The sagebrush was burned in 1933 and the quadrats were remapped and classified in 1934. Twenty quadrats were totally unburned, 15 were burned lightly, 12 moderately and 12 were heavily burned. The sagebrush was completely killed on all burned quadrats.

The basal area of the grasses as a whole increased 24.4 per cent on the moderately burned area but underwent no significant change in area on the other plots. Agropyron dasystachyum and Koeleria cristata representing 22 per cent and 29 per cent of the total grass basal area in 1932, increased 62.4 per cent and 31.1 per cent respectively following moderate burning. However, the number of all grass plants per plot increased significantly following all treatments except moderate burning. The total number of Agropyron plants increased in all cases, while Poa plants increased following moderate and light burning. Agropyron Koeleria definitely increased in basal area per plant, while on the other hand, Poas decreased in average basal area per plant but increased in numbers on light and moderate burns.

This preliminary analysis indicates that moderate burning has an immediate beneficial effect on the perennial grass population of sagebrush-wheatgrass ranges. Further analysis of data gathered during the past year, including estimations of 400 transect plots, detailed maps of 58 browse plots, studies of plant vigor, soil changes due to burning, etc., as well as a continuation of study over a longer period are necessary before definite conclusions can be drawn regarding the true benefits of burning sagebrush-bunchgrass range.

Mortality and Reproduction of Desert Forage Plants

Palatable shrubs on a desert range grazed only when snow is available have on the average suffered in one area near Desert Branch Station a death loss of about 20 per cent during the last 3 years of drought. On a nearly comparable range, accessible to water and heavily used for many years, the death loss is about 67 per cent. The more palatable species have suffered more than the less palatable ones as shown in Table 1.

Table 1. Comparison of the percentages of mortality resulting from 3 years of drought combined with light and heavy grazing.

Species	Palatability	Mortality by Degrees of Grazing	
		Light	Heavy
Oryzopsis hymenoides	high	% 24	% 89
Eurotia lanata	high	11	67
Atriplex confertifolia	medium	28	33
Chrysothamnus stenophyllus	very low	10	7

Not only are the best desert forage plants being killed by drought and heavy grazing combined, but they are also failing to reproduce under heavy grazing. Meanwhile the unpalatable species are making a wholesale invasion of the sites formerly occupied by the original palatable species. Near the Desert Branch one area showed only 7 per cent of the highly palatable white sage (Eurotia lanata) under 21 years of age as estimated by ring counts and practically none under 10 years of age. On the other hand 91 per cent of the unpalatable little rabbitbrush (Chrysothamnus stenophyllus) is less than 21 years of age and 45 per cent less than 10 years of age. Absence of reproduction of palatable species can mean only that they are destined to become extinct, or nearly so in two or three plant generations, and perhaps in one. Simultaneous high reproduction of unpalatable species accomplishes the wholesale replacement of palatable forage plants.

Precipitation and Forage Yield on Summer Ranges

It has been commonly accepted that abundant precipitation will result in high forage yield on the summer range. Studies of precipitation and plant growth at the Great Basin Branch during the period 1925-34 reveal, however, that whereas high annual precipitation usually results in high forage yields, the distribution of moisture through the growing season may be of equal importance. Seasonal distribution may account for irregular relationships between forage yield and climate, as in 1928 when forage yield was high in spite of low precipitation, and in 1930 when the opposite conditions prevailed. Several methods of grouping the precipitation data have been used, in an effort to determine more precisely the influence of the moisture factor on plant growth and yield. These groupings, with yield correlation coefficients, are listed below.

Yield - total yearly precipitation	- $\frac{r}{.431}$
" - (1) May-Sept. "	- .147
" - (2) precipitation from date snow off to seed mature	- .382
" - (a) precipitation from date snow off to heads showing	- .572
" - (b) precipitation from heads showing to through blooming	- .180
" - (c) precipitation from through blooming to seeds ripe	- .132
" - precipitation from date snow off to heads showing + available soil moisture at date snow off	- .741

Least significant value - .632
Highly " " - .765

Several of the precipitation groups set up in this preliminary study are of little significance. Two of the groups, total annual precipitation and the amount which occurs from the time snow leaves in spring to the time flower heads appear, are fairly significant but are not considered reliable because of inconsistencies. On the other hand, when the amount of moisture in the soil at the time of snow departure is added to the precipitation that follows up to the date heads appear, a highly significant index of ultimate forage yield for the year is approached. It is quite possible that a precipitation soil moisture index may be used for predicting the forage yield for the year.

Analyses of the relation of forage yield to temperatures, evaporation, cloudy and clear days, and other climatic factors are now in progress.

Erosion & Streamflow

Erosion in Colorado Plateau Province

Reed W. Bailey, in attendance at the Christmas meetings of the American Association for the Advancement of Science in Pittsburgh, presented a paper on "Epicycles of Erosion in the Valleys of the Colorado Plateau Province." This paper, is a summary of observations and study of erosional phenomena in the Upper Colorado River drainage. It should be of particular interest to foresters since geologic evidence is presented suggesting that the present accelerated rate of erosion on several typical tributaries of the Colorado River has been caused by a change in plant cover on these watersheds and not by diastrophism or climate as has been suggested by some observers.

Based on his interpretation of certain physiographic features which have been exposed in sections of recently excavated stream channels and other evidence in unexcavated valleys, Bailey suggests that the present general topography in the Colorado drainage has been caused by an ancient series of erosional processes that were induced by vicissitudes within climatic epi-cycles rather than by a gross change in the climatic norm.

Whereas erosion is progressing and will probably continue to progress at a rapid rate over the region as a whole, there is no indication that this rate has been accelerated on areas where the vegetative cover at the headwaters of the drainages has not been disturbed or on areas where vegetation has never been a factor such as in Bryce Canyon. On the other hand, greatly

accelerated erosion is now occurring for the first time in many geologic years on such tributaries as Kanab Creek and Johnson Wash in southern Utah. The occurrence of this type of erosion cannot be attributed to diastrophism or climatic change but appears definitely to be the result of a change in the vegetative cover which followed in each case shortly after the settlement of the valleys by man.

Erosion Factors on Davis County Watershed

During 1934, an attempt was made to measure some of the many factors which it is believed have contributed to the menace of floods on the Davis County watersheds near Ogden, Utah. With this in view, a series of contour transects were established in the headwaters of several streams on situations where most of the run-off has been observed to accumulate and where the most serious erosion has occurred. Enough plots were established on these transects to obtain statistically reliable data with respect to the extent that erosion is influenced by plant density, slope and exposure.

When analyzed by the variance method extremely significant values were obtained with respect to the effect of plant density on erosion - thus substantiating conclusions reached in preliminary observations that recent disastrous floods from these areas occurred in a large measure as a result of the destruction of the plant cover on critical portions of the watersheds.

Contrary to what might be supposed, slope and exposure appeared to be of no significance in relation to erosion on these areas insofar as the analysis of the data has been made to date. There are indications that slopes and exposure cannot be ignored, however, and it is expected that further analysis will bring out a more accurate evaluation of these two factors.

Erosion Installations

Word has just been received from the Boise Basin Branch at Idaho City, Idaho that seepage flow is now occurring on Area B of the 11-acre paired watersheds. Seepage flow has been relatively constant from Area A since the cut-off wall was constructed but no flow had been observed previously from the other area. The seepage flow from both areas has been negligible thus far.

No surface run-off has occurred on the watersheds as yet nor has there been either seepage or surface flow from a battery of six lysimeters which were also installed last summer.

LAKE STATES FOREST EXPERIMENT STATION

Shelterbelt Investigations

Field parties on the Shelterbelt project are being disbanded and the men are beginning to drift into the office at St. Paul.

As a result of the recent field work it has been possible to draw up recommendations as to what species should be planted on the various soils occurring within the area of proposed Shelterbelt planting. For each of the important soil types notes were made regarding the growth and development of all the tree species found growing naturally on the type. On the basis of these data definite statements can be made as to the adaptability of the different species to each of the soil types.

The intensive review of Russian literature on the subject of shelterbelts has been completed. A very large amount of material has been carefully scrutinized and evaluated. A summary has been prepared which briefly states the recommendations which can be drawn from the Russian experiences.

Mr. Zon addressed a meeting of the Saturday Lunch Club in Minneapolis on the subject of the Shelterbelt. He discussed the prospects for successful planting in the Plains region and roughly outlined some of the methods to be used in overcoming the obstacles to tree planting in that type of country.

He also spoke at a meeting of the Minnesota Section of the Society of American Foresters on the same subject.

Forest Survey

All field parties on the Forest Survey have now moved to the Lower Peninsula of Michigan after having completed strip surveys in the western part of the Upper Peninsula. With many more roads and less snow in Lower Michigan, the work should progress rapidly.

Errors of Forest Survey

Practical methods of estimating the errors involved in the Forest Survey of the Lake States have been worked out. The errors attached to estimates of volume cause no particular trouble, but errors in the estimate of the areas of the several types have been very difficult to determine. As a result of logging and land clearing, what little order ever existed in the natural arrangement of the original types has been completely destroyed. The result is that no one general pattern of distribution of types can be relied upon to hold over any extensive area.

Type Map

A land type map for Minnesota was completed by members of the Forest Survey personnel. In order to gain an idea of the possibilities for forest growth and also to aid in planning land use, six land types were recognized: pine land, hardwood land, spruce-fir land, coniferous swamp, aspen-scrub oak land, and aspen land. The entire state was mapped according to these six types. The Forest Survey will eventually compile statistics for these natural divisions.

Seed Studies

The Station has taken on the job of working out proper methods for handling seed for shelterbelt planting. It is perfectly astounding how little published information there is on many of the species which will be used and what there is is scattered throughout many obscure periodicals. Unquestionably there is much valuable material in existence in manuscript form at many of the agricultural experiment stations and colleges, and much more resides locked-up in the heads of practical nurserymen. The question is how to make the information generally available to practicing foresters and nurserymen.

What is really needed is a seed manual for all species used for reforestation. It is no simple task to compile such a book, but once it is done, it should be of inestimable value.

NORTHEASTERN FOREST EXPERIMENT STATION

Forestation

It was learned during the recent plantation survey of the station that little or no information concerning seed source or nursery treatment could be obtained for planting stock grown in most of the nurseries. The station has compiled a set of tentative nursery forms upon which the desired information can be placed by the nurseryman and thus be made available for future reference. During the early part of the month Morey discussed the use of the forms with those in charge of the several state nurseries. Several of the nurserymen expressed their willingness to give the proposed system a trial during the next year.

Protection Fire

In connection with our forest fire data, Stickel has recently completed a revision of the various alienement charts in which a 24-hour evaporation reading taken at 5 p. m. has been substituted for relative humidity. With these new charts an improvement of between 9 to 13 per cent in the accuracy of estimates of duff moisture content is obtained; the final alienation indexes range between 0.412 to 0.456. It is planned to distribute these new charts to the state foresters and at the same time to call their attention to the ease with which 24-hour evaporation readings can be obtained with such a simple device as Wright's modified open pan evaporimeter.

The study of bark character and variation in heat resistance of trees is furnishing some rather interesting data. A preliminary review of the monthly bark moisture determinations of the six species under consideration seems to indicate that the bark of the less fire resistant species contains considerably more moisture during the course of the year than that of the more resistant species. Thus, balsam fir which is known to be low in fire resistance, contains on the average 25 per cent more water than the other two conifers, pitch pine and hemlock; beech, which seems to be less fire resistant than sugar maple or chestnut oak, contains approximately 10 per cent more moisture than the other two hardwood species. The anatomical study of the bark of the above species likewise indicates a greater differentiation of cellular structure in the case of the species high in heat resistance than those which are more easily damaged by fire.

Protection, Insects

Mr. W. L. Baker of the Forest Insects Laboratory at Melrose Highlands, Mass., is spending some time with Doctor MacAloney, working up his data on gipsy moth observations. While at the station Mr. Baker will confer with Mr. Behre and the other foresters concerning the forestry aspects of this project.

Protection, Diseases

The last three months have been largely spent in completing necessary field work to enable working up of accumulated data in the office. The E. C. W. work on Nectrias, largely carried on by T. J. Grant and Alice J. Watson, is still at such a stage that trends only can be given. Twenty-seven strains of Nectria taken from most of the northern hardwoods were used early last spring to make a series of cross inoculations. Thru the kindness of Supervisor Mattoon, an especially favorable stand for the purpose on Cherry Mountain, New Hampshire, was used. Canker formation began within a month and the size of cankers increased until the trees came into full growth, since which time it has been practically stationary. Beech, mountain maple, striped maple, and aspen appear to be especially susceptible to most of the Nectrias tested. This emphasizes the danger of weed species as sources of infection for the higher class hardwoods. The experiments should run for some time before final conclusions can be drawn. The Nectria associated with the beech coccus in Maine and the Maritime Provinces has not yet shown the aggressiveness that our more common Nectrias exhibit, altho it has been found occurring naturally in both the White Mountains and Green Mountains. That is, without the insect it appears to be of minor importance. Experiments in methods of cutting and handling cankered trees thus far have shown that available moisture largely controls fruiting activity of the Nectrias. This means that silvicultural operations, such as thinning, selection cuttings, etc., which open dense stands, should tend to reduce Nectria damage by reducing moisture of the air. Rather slight change in this factor may be quite decisive. Such operations reduce injuries from trees and branches rubbing against each other and give less opportunity for Nectrias to infect thru such wounds.

Forest Economics

The field work on the white pine cost of logging study being carried on in cooperation with the Forest Products Laboratory, was completed during the past month. The areas on which the study was carried on were representative of pine stands now being logged in the New England states. Data were obtained on partial and clear cutting operations, the more common methods of logging, and at mills varying from a seasonal portable to a well established permanent plant. The study was limited to six operations, located in

Maine, Massachusetts, and New Hampshire. Permanent sample plots were established on the areas before cutting operations, and will be maintained by the Station. Logging and milling data were collected on 2,500 trees having a total volume of about half a million board feet; these data are now being analyzed at the Forest Products Laboratory.

General

Patent No. 1,978,476 dated October 30, 1934, has been issued to Reineke for his movable, constant-orientation mapboard for fire lookouts. The object of the invention is to provide a means whereby the mapboard can be moved to secure a clear line of sight past cabin corner-posts, etc., without disturbing orientation of the map. A full description will soon appear in the Journal of Forestry. The patent is assigned to the public.

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Range

The 1934 drought reduced range forage production at Miles City to a small fraction of normal. The 60 experimental cows were moved to winter pastures in October, a month earlier than schedule. These pastures had not been grazed since May but the season's growth of forage was used up within a month and the cows had to be removed and placed entirely on hay during the latter part of November. They go into winter in thinner condition than ever before despite the fact that they had hay to supplement range forage during the summer, varying in total amounts from 2027 pounds per head for the overgrazed lot, 1267 pounds per head for the moderately grazed lot, to 848 pounds per head for those on range that has been about 25% undergrazed heretofore. Calves from the latter averaged 72 pounds heavier at weaning time. At prevailing cattle prices these cows will all "eat their heads off" long before time for another grass crop. The cost of range and supplemental feed per pound of calf produced in 1934 was about 8-1/2 cents per pound for the overgrazed lot as against about 3-1/2 cents for the moderately grazed lot, or a penalty of about 240 % for overgrazing during a drought year. High cost of wintering without range forage will carry the effects of the 1934 drought into results for 1935, even if the coming year proves to be a good grass year.

An article giving preliminary results of the artificial range reseeding work was prepared at the request of the American Hereford Journal. It appeared in the annual Range Edition December 15, 1934. Briefly, results to date indicate more or less satisfactory stands on about 1/3 of 225 acres seeded in the fall of 1933 and in the spring of 1934. This is considered distinctly encouraging in view of the severe drought. Results on about 425 acres additional seeded in the fall of 1934 will not be known until late in 1935. Twenty-one Montana counties are represented by cooperative reseeding tests.

Logging and Milling

During the month Anderson completed the office memorandum for the selective logging study of the Ohio Match Company operation on the Coeur d'Alene Forest. A trade journal article, presenting the results of this study to the industry, was partially completed and will be ready for publication in January or February.

Unfortunately we were unable to carry this study through the match block factory in Spokane so were unable to obtain the effect of size, age, and other variables upon the yield of match blocks. We did, however, get a good comparison of production costs and

selling values based upon conversion of trees to match plank as a major product. Using present code prices and allowing a stumpage cost of \$4.50 per M' the point of zero-margin falls between the 15 and 16-inch tree. Eliminating the stumpage cost the zero-margin point was determined to be between 12 and 13 inches, or the 13-inch tree was the smallest sized tree that indicated a positive margin.

Fire

The value of maps showing the distribution of good rains (0.20 inches or more) is again emphasized by the maps just completed for the 1934 fire season in the western part of Region One. As in previous years, the 1934 maps indicate that they are of value to the fire weather forecaster and to the administrative forest protection force.

The spotted character of good rains in the mountainous country indicates the necessity for localized forecasts. During June, July, August, and September, 1934, only four out of 28 good rains covered a major part of the western Forests and only one of these was region-wide. Such spottedness makes the task of localizing forecasts very difficult.

The wet and dry belts that occurred in 1933 did not recur in the same places in 1934. The evidence for the two years shows only one consistent dry zone, the Meadow Creek district of the Nezperce.

Some of the dry spots persisted for extremely long periods during the past summer. As many as 85 consecutive days without a good rain occurred at some stations. Such localities demand more intensive protection than areas with more frequent rains, other things being equal. A current drafting of rain maps during the fire season reveals the development of these dry areas and permits administrative action to meet the situation.

Rainfall records were obtained from enough stations during July and August of this year to permit the construction of a map showing the total precipitation in the western part of Region One. It is interesting to note that all major fires occurred in areas with rainfall less than 0.50 inches for July and August, 1934. The map indicates the great variation in amount of rain that can exist within a very few miles. One lookout station on the Nezperce Forest measured 0.10 inches of rain during July and August while another lookout station 19 miles away recorded 1.52 inches.

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Section of Forest Products

A number of requests regarding the composition and effectiveness of Wolman Salts have been received following announcement by the Crossett Western Lumber Company of its intention to install a plant at Wauna, Oregon.

Products has also been called upon for advice on such things as linseed oil treatment of diving boards, wood moisture--relative humidity relations at different temperatures, and the relative fuel values of Douglas fir, western hemlock, and Sitka spruce sawdust. In addition the normal number of requests for forest products statistics have been received.

Mr. C. C. Kuehn of the Federal Creosoting Company spent a week in Portland checking the possibilities of obtaining long fir pilings. The plan is to treat these in the southern plants of the company and then ship for installation in East Coast ports.

Douglas Fir Mill Production Studies

Computation is proceeding on the 300 logs analyzed during November. The summary sheets for each log have been made and checked, and tables showing lumber grade recoveries for each log grade are practically complete.

One of the mills studied this year had no edger. The one- and two-inch stock was piled beside the transfer rolls until sufficient had accumulated to warrant edging. From 8 to 16 boards were then stacked on the carriage and edged and ripped on the head-saw. A comparison of the footage obtainable under careful edging with that actually recovered showed a loss of 11 per cent. The mill was selling these thicknesses at an average of \$11 per M. Thus there was a monetary loss of \$1.21 per M on the one- and two-inch stock, to which should be added the loss of time occasioned by the edging operation.

Deterioration of Fire-killed Douglas Fir

Early in December Rapraeger completed the field work on this project; about 40 fire-killed areas were examined and notes taken on the rate of deterioration of the timber. The oldest burn examined was the Yacolt (1902) fire and the most recent was the Tillamook (1933) fire; each of these destroyed billions of feet of timber. Douglas fir timber in the Yacolt area is no longer suitable for lumber but considerable wood is still being taken out by wood cutters; commercial logging in this area closed about 10 years ago.

Salvage is now under way in the Tillamook area along the edges of the burn. Only the Douglas firs will be taken in the course of logging, since the hemlocks are already riddled with ambrosia beetle galleries. The Douglas firs are still sound, but about 50 per cent of the trees are sap stained.

Pulpwood Conversion Values

Computations on the pulpwood measurements made last spring have been completed, and the first draft of an office report has been started.

Measurements of the solid wood contents of 137 cords of peeled split wood indicate that there is little relationship between number of sticks and the cubic feet per cord within the range studied. An average of 86 cubic feet per standard cord was obtained.

In old-growth hemlock and white fir the percentage of total tree volume utilized on the cordwood operations increased from 60 per cent in 8-inch trees to 91 per cent in 20-inch trees, and then decreased to 88 per cent in trees over 30 inches in diameter. In second-growth hemlock and spruce the same trend was observable but attained a maximum of only 83 per cent at 20 inches and decreased to 76 per cent in trees over 35 inches in diameter.

Statistics

All census forms and envelopes have been received and properly stamped. They will be addressed and mailed shortly after the first of the year.

Log, burl, and round timber exports for the first eleven months have been compiled.

Numerous requests for "Log, Burl, and Round Timber Exports from Oregon and Washington, 1920-1933" have necessitated mimeographing a second edition.

Forest Survey

Mr. Geo. T. Wilkinson of the Engraving Division of the U.S.G.S. spent ten days in Portland going over problems involved in lithographing the 1/4-inch-to-the-mile regional type maps. All the Forest Survey's 48 detailed types as used both in the Douglas fir region and the country east of the Cascades have been consolidated into 25 types for the two States. With Mr. Wilkinson's help a combination of colors and patterns were selected to show these 25

types. Other technical details of drafting and procedure were straightened out. Since Mr. Wilkinson's visit the types for most of northwest Oregon have been generalized, the transfer of these type lines to the nonphotographic blue maps which will be forwarded to Washington will be started in January. It is hoped to have copy for the northwest quarter of Oregon ready for the lithographer early in February.

Douglas fir region

Material progress in writing the textual analysis of the eleven units has been made, with six of the Survey staff working continuously at this job. A statistical comparison of timber volumes of the ten national forests of the Douglas fir region prepared by C. W. Kline has been issued in mimeographed form and distributed to a selected mailing list.

Forest Economics

Selective Logging

Brandstrom, accompanied by Messrs. Ericson and Wright of the Regional Office, and Supervisor Mitchell, spent four days on the Siskiyou National Forest in connection with a proposed experimental timber sale of Port Orford cedar. Incidentally, he looked over the proposed natural area on Rock Creek. A tract of Port Orford cedar located in the Rock Creek watershed was selected for a demonstration of light selective cutting. Mapping and cruising of this area is to be undertaken by the Regional Office in the near future, after which a logging plan will be prepared and the trees to be sold marked for removal.

Brandstrom also cooperated with the Regional Office in drawing up cost keeping forms for a proposed experimental selective logging project, and in drawing up directions for mapping and cruising two areas of timber on which the Regional Office plans to experiment with light selection.

New Public Domain

On behalf of the Land Classification and Use Committee and at the request of the Agricultural Committee of the Oregon Planning Council, Wilson presented the report and plan for a classification of the agricultural lands of Oregon at a conference of the Oregon Planning Council with Governor-elect Martin on December 5. Considerable time was spent during the month upon remedial legislation affecting the use of land, being sponsored by the Oregon Planning Council and being recommended by the Pacific Northwest Regional Planning Conference. Particular attention was given

to proposed zoning, sustained yield, public acquisition, and deferred timber tax legislation.

Wilson spoke on "Some Practical Aspects of Land Planning" before the Land Resources Division, and on "Land Use Zoning in the Timbered Sections of Oregon and Washington West of the Cascade Range" before the County-Municipal Planning Division of the Second Pacific Northwest Regional Planning Conference at Seattle.

Kearns has completed the computation of data for sample school districts taken last fall bearing upon the valuation for tax purposes, the tax burden, tax delinquency, and intent of ownership.

Section of Silviculture

Fire Studies

Acting upon the urgent request of Mr. E. T. Allen and Assistant Regional Forester Merritt, an exhibit was prepared for the Western Forestry and Conservation meeting held in Portland December 4 and 5 showing some of the new equipment for measuring fire danger, including instrument shelter, hazard indicator sticks and scales, fan psychrometer, and haze meter. On the day following the meeting, Dague, Malin, Hannah, and Gray, Weather Bureau fire weather service men from Portland, Seattle, Spokane, and San Francisco, respectively, called at the Station on Matthews and Morris and evidenced a very cordial interest in all the inexpensive equipment for measuring fire danger that has been developed by the Station.

Douglas fir slash disposal

During the past summer charred and uncharred sections of the same pieces of slash material (poles and limbs) were weighed daily to determine the rate at which they took up and released moisture. The figures showed that charred segments of slash were thoroughly dried by the end of July and lost no more moisture during the summer, while uncharred sections of the same pieces of material continued to lose weight until the fall rains started on September 8. When rains occurred or the samples were placed under sprinklers, the charred sections took up moisture as rapidly as uncharred, but dried out twice as rapidly as the uncharred samples.

SOUTHERN FOREST EXPERIMENT STATION

Protection - Fire

Pessin recently completed remeasurements of slash pines on the 500 acres of plantation at Bogalusa, La., burned over in April 1932, when the trees were 9 years old, and on adjacent unburned portions of the same plantation. It was found that during the third growing season after the fire, the rate of growth in height of the trees on the burned area was about the same as that of the trees on the areas which had not burned. During two growing seasons (1932-33) the rate of growth in height of the trees on the burned area was less than that of the trees on the unburned area. It appears that the period of retardation of growth caused by this particular spring fire lasted for two years.

Forestation

Huberman and McKellar supervised the lifting and grading, and Wakeley and Olsen the planting, of 38,000 slash and longleaf pines on the experimental planting area near Alexandria, La., using CCC labor. For the planting, the Supervisor and Camp Superintendent furnished the Station with a picked crew and after three days of training the boys demonstrated their ability to vary mixtures and spacing well enough for the purposes of this winter's tests. Mixtures of species and various systematic combinations of graded slash pine stock were planted during the training period and then the crew settled down to spacing plantations, which will make up the bulk of the winter's work. It is hoped to plant about 400,000 trees in experimental plots before the end of February.

Wakeley set out at Bogalusa, La., approximately five dozen hybrid pines from natural and artificial back crosses on a longleaf loblolly hybrid growing in Washington Parish, La.

Financial Aspects

A report, entitled "Use of Land for Forests in the Lower Piedmont Region of Georgia," was completed by Bond and Spillers. This report shows that four-fifths of the total area of this region has been cleared at one time or another, but that 56 per cent is now in forests, and that 17 per cent is now in idle land, 70 per cent of which is unfit for agriculture. Serious erosion is common and chiefly responsible for the abandonment of land from agriculture. A farm in Meriwether County, Georgia, typical of this region, illustrates the financial possibilities of present forest stands. It has 230 acres forested, of which 160 are old-field pine, 18 acres

upland pine and hardwoods, 32 acres branch-head pine and hardwood, and 20 acres bottomland hardwoods. In addition, 17 acres of abandoned farm land is available for forest growth. The total annual increment of sawtimber on the farm is 22,670 bd. ft. of pine and 5,613 bd. ft. of hardwoods and its value at current stumpage values of \$2.50 per M bd. ft. of pine and \$2.00 for hardwoods, totals \$67.91 or 30 cents per acre. The better stocked stands show an annual increment of 237 bd. ft. of pine, valued at 59 cents per acre. In addition to sawtimber, 22 cords of fuelwood and 150 fence posts can be cut annually from tops, thinnings, and improvement cutting. The annual costs of forest management for the farm woodland are: Taxes at 14 cents per acre, or a total of \$32.20 for the 230 acres of forest land; 3 man-days labor in fire protection; and 26-man days in thinning and improvement cuttings. With better quality timber produced in better stocked stands, the income could be increased two or three times over that now received. On 95 per cent of the area in old-field pine stands erosion has been stopped by forest growth.

Management

Controlled Burning

Between December 3 and 13, approximately 400 acres of the Dry Prong Division of the Station's Experimental Forest on the Kisatchie National Forest, La., were burned over by Gemmer, Wakeley, Olsen, and Huberman, to aid in providing a suitable seed bed for longleaf reproduction. Burning plans called for controlled fires on a number of areas, varying in size from 40 to 130 acres.

Three general problems have arisen as a result of this work: (1) The question of maximum area that can be burned by the average crew; (2) the question of just how going fires are to be studied; and (3) the question of damage.

The problem of area and crew size is one largely of administrative efficiency. The ideal crew appears to be: One boss, two sub-bosses, six to eight men, plus one extra man for each 10 chains of line to be patrolled. Man-power at or near point of ignition varies considerably with the care with which firelanes are constructed. Double-graded lanes, such as made by a tractor-grader outfit are capable of stopping most back-fires, except where scrub oak or brush is encountered. Firelanes are absolutely necessary. Using roads and ridges to define the area to be burned would avoid the necessity of poorly constructed lanes, but does not take into consideration the silvicultural necessities of the area.

A study of the relation of meteorological conditions to severity and rate of burn indicated that the severity of burn was a factor of the moisture content of the fuel and of the wind velocity. Severity appeared to be proportional to lapse of time since last rain. Rate of burn appeared to bear direct relationship to wind velocity. Relative humidity, on the other hand, seemed to be a poor indicator of either severity or rate of burn. Topography also had a marked effect on both rate and severity of the fire.

The problem of studying a going fire has never been completely solved by this Station. The form now in use, "Record of Experimental Burning," is unsatisfactory on large fires. The obvious conclusion is that a study of fire is the full-time job of an expert. He should be responsible for determining the factors requiring specific measurements, devise a form adequate for the situation, and preferably be on the job during all extensive controlled burns.

Stand Improvement

Bull started an analysis of the girdling and poisoning study established on the Ouachita National Forest, Arkansas, by Roy Chapman in 1929-30-31. In the course of three seasons, Chapman deadened 1,731 hardwoods, from 4 to 23 inches d.b.h., by one of three methods: namely, girdling, girdling and injecting various poisons, and hacking and injecting poisons. The object was to determine the relative effectiveness of simple girdling and the various poison treatments with respect to mortality and sprouting. The trees were re-examined by Chapman and Bull in November, 1934.

Based on this last examination, it is evident that the mortality due to simple girdling (largely double-hacking) is essentially as complete as the mortality due to girdling and poisoning. Excluding a few trees still living because of incomplete girdling, 98.4 per cent of the girdled trees and 99.8 per cent of the girdled-and-poisoned trees were dead after 5 years. Of 20 trees poisoned in two axe hacks, one on the opposite side of the bole from the other and not girdled, 40 per cent were still living after 5 years. Of 20 trees poisoned in a single axe hack, and not girdled, 70 per cent were still living after 5 years. The effect of poisoning in isolated axe hacks was to kill only the portion of the bole directly above and below the hacks, and it was evident that the continued growth of the remainder of the bole, and the crown, was due to the failure of the poison to spread laterally from the hacks. Thus the poisons were thoroughly effective only when applied completely around a girdle, and since the girdling alone was very effective in killing the trees (at least during 5 years), it appears that poisoning is unnecessary and only adds to the expense of deadening.

Poisoning might still be desirable in some instances, if it greatly reduced sprouting, but the analysis of data indicates that the poisons have apparently had no appreciable or consistent effect on sprouting. Some of the poisons appear to have delayed somewhat the disintegration and fall of the smaller trees, even though the poisoned trees in general died sooner than the merely girdled trees.

Forest Survey

All of the deep-water areas in the Delta, with the exception of a few miles in the Reelfoot Lake country of Tennessee, were completed. The houseboat work in the Grand Lake country was also completed. This will enable the hardwood crews to work in the higher ground throughout the winter season.

The Alabama Unit was completed and the crews moved to Louisiana and central Mississippi. Supervisor Faulks moved his headquarters to Jackson, Mississippi. Work was started by three of Cruikshank's crews in southwestern Louisiana.

Forest Survey Release No. 6, "The Preliminary Report on the Forest Survey of the Bottomland Hardwood Unit in Mississippi," was completed and released.

Entomology

Dr. T. E. Snyder reported the following activities:

1. A talk on termites at the McMain High School, New Orleans, La., on December 6th, 1934.
2. Inspection of chemical spray tests against ambrosia beetles at Crown Point, La., Dec. 17-19, 1934, in cooperation with representatives of the Mansanto Chemical Company, St. Louis, Mo.
3. Investigation of faked reports of the failure of the metal termite shield or mechanical barrier.
4. Investigation of accidental damage to Celotex by prepupal larvae of the hide beetle.
5. Unusual case of erosion of pine timbers in a dam in the Cumberland River, Eddyville, Ky., by caddice fly larvae, reported by the U.S. Engineers' Office, Nashville, Tenn.

Pathology:

Hatfield visited several sawmills in Mississippi and Louisiana to observe the types of dipping vats used and the stain prevention results that are being obtained.

Culture dishes were exposed at four of the mills visited in order to determine if possible the kinds and frequency of stain organisms in different locations in the mills. These dishes were examined and culture isolations made so that identification could be undertaken. The results to date show:

1. That there is sufficient inoculum present in the air to assure infection of the lumber at any stage of the lumber processing from the header saw to the green chain and seasoning yard.
2. That a wide variety of stain organisms are present in the air. To date, stain organisms representing five genera have been isolated.
3. As many as 15 individual sap-staining organisms have been obtained on an area of 10 square inches, exposed for only 15 seconds in the sawmills.

These few preliminary experiments indicated the reason why dipping or some other form of protection must be given the lumber soon after sawing, if stain is to be prevented.

RESEARCH - REGION 2

Growth in Cut-Over Stands (Me-6)

The final report for the spruce type "Growth and Yield in Cut-Over Stands in the Engelmann Spruce Type", by Supervisor W. J. Pearce, was reviewed and edited early in the month by Messrs. Thompson and Roeser. The report will be ready for submission in January.

Gully Erosion on Cottonwood Creek (Pe, San Isabel)

The results of measurements made last October in connection with this 2-year old study were compiled and presented in a progress report. During the past year, 1934, the rate of erosion, as expressed by the longitudinal and lateral extension of the gully under study, was materially less than it was during the preceding year, 1933. This was probably due to the relative absence of heavy rains during the season. As was the case in 1933, erosion was more active near the lower end of the gully than at the upper end. Three profiles located immediately above the head, about midway between the head and the mouth, and near the mouth of the gully experienced cross-sectional area increases of 6.4 per cent. 10.2 per cent and 18.2 per cent respectively during 1933. In 1934, the upper profile decreased in area filling exceeding cutting by 1.3 per cent, while the other two profiles increased 0.4 and 2.6 per cent respectively. Since August, 1932, the head of the gully has moved forward 3.04 feet on an average, 75 per cent of this advance being made during the first year.

Progress of Reproduction and Revegetation on the Rochford Burn (Mr-1)

Direct seeding with ponderosa pine seed in the fall and spring following the extensive and destructive fire in the Black Hills of September, 1931, has resulted in complete failure. Only a very few scattered seedlings have established themselves naturally since the fire; however, in 1934, a heavy cone crop was produced, which promises to yield an abundant supply of seeds for the initial phase of reestablishing the stand. The data on other vegetation have been compiled but have not yet been summarized. It appears that there was little change in the density of the ground cover as compared with 1933 even though the season was an unusually dry one. The influence of the drouth is apparently reflected in a decrease in the proportion of grasses and weeds and a concomitant increase in the proportion of shrubs. The vegetative cover seems to be adequate enough to have checked any tendency toward excessive erosion since approximately one year after the fire.

Miscellaneous

Precipitation at the Fremont Station in Colorado totaled 13.80 inches for the year 1934. This amounts to only 64 per cent of normal precipitation and establishes the year as the driest in the history of the local weather station. The previous annual minimum, 15.10 inches, as recorded in 1924. The mean air temperature also broke all previous records. The average recorded for the year was 42.56°F., and for the growing season, 58.04°F. Corresponding normals since 1910 are 38.92°F. and 55.42°F. The prolonged drought is seriously affecting water supplies and its effect upon plantations, especially some of those established in 1934, has been disastrous. One source-of-seed plantation at the Monument Nursery has been completely wiped out.

During the month the last of the series of reports on the spruce type, "Growth in the Engelmann Spruce Type within the Rio Grande Basin of Southwestern Colorado", was submitted.

Attention is called to a discrepancy in the account of climate in relation to forest planting in the Nebraska sandhills that appears in the October, 1934, report. The table on Page 56 should be corrected to read as follows:

Period	Annual		Growing Season	
	H-2	H-4	H-2	H-4
Location	Within plantation	In open	Within plantation	In open
Mean maximum air temperature degrees F.	62.00	63.37	84.91	84.61
Mean daily air temperature range, degrees F.	27.83	26.54	30.97	28.62

Also, the growing season is considered as beginning on May 11 rather than on May 10.

MANUSCRIPTS

PACIFIC NORTHWEST

Kline, C. W. Comparisons of national forest timber estimates in the Douglas fir region (Mimeographed and distributed)

McArdle, R. E. A Visibility Meter for Forest Fire Lookouts. (Journal of Forestry)

Morris, W. G. Lightning Storms and Fires (Paper presented at the Northwest Scientific Association meeting in Spokane, December 29)

Matthews, D. N. New Devices for the Forest Fire Protectionist (Paper presented at the Northwest Scientific Association meeting in Spokane, December 29)

ALLEGHENY

Schnur, Luther G. Yield, stand, and volume tables for even-aged upland oak forests. (Technical Bulletin)

Jackson, L. W. R. and Sleeth, Bailey A new disease affecting Platanus orientalis in the Eastern United States. (Phytopathology)

Jackson, L. W. R. and Crandall, B. S. A Phytophthora root and collar rot of Pinus resinosa seedlings. (Phytopathology)

Doak, K. D. and Fisher, P. L. Mycorrhizal and pseudomycorrhizal infections of pine roots during first year's growth, (Phytopathology)

Doak, K. D. and Lisi, Alfred G. A morphological comparison of compound forms of mycorrhizae, (American Journal of Botany)

IN PRINT

Chapman, A. G. The Effects of Black Locust on Associated Species with Special Reference to Forest Trees (Ecological Monographs, Jan. 1935)

Conhaughton, Charles A. Growth in Virgin Ponderosa Pine Stands in Central Idaho. (Jour. For. Jan. 1935)

Doak, K. D. Mycorrhizae and their relation to shade trees. (Proc. Tenth National Shade Tree Conference: 99-105)

Forbes, R. D. Tionesta Forest. New York Times (Sunday Supplement), January 6, 1935

Hornby, L. G. Fuel Type Mapping in Region One. (Jour. For. Jan. 1935)

Hough, A. F. Natural enemies of the forest (Forest Leaves 24: 3-6)

Isaac, Leo A. Life of Douglas Fir Seed in the Forest Floor (Jour. For. Jan. 1935)

Morris, W. G. Forest Fires in Oregon and Washington (Oregon Historical Quarterly, December, 1934)

Schnur, G. Luther Diameter Distribution for old-field loblolly pine stands in Maryland. (Jour. Agr. Res. 49: 731-743 illus.)

Wood, O. M. A brief record of seed productivity for chestnut oak in southern New Jersey. (Jour. For. 32: 1014-6)

Wood, O. M. The root system of a chestnut oak (Proc. Tenth National Shade Tree Conference: 95-98)

TRANSLATIONS

No. 64. Extracts from "Agrolessomelioratsia V Oroshayemon Zavoljie" (Improvement of Farmland in the Irrigated Region of the Zavoljie (East of the Volga)). By Gorshenin, Panfiloff, Godounoff, Barabanshtikoff, and Kolomeitseff, From "Opty I Izsledovania Vsesoyuznogo Naouchnoizsledovatel'skogo Lessokulturnogo I Agrolessomeliorationogo Instituta." (Experiments and Investigations of the All-Union Research Institute for Silviculture and Improvement of Farmland by Afforestation, known as "Vniliami") Moscow, 1934. No. 4, pp. 5-143. Translated from the Russian by Dr. de Blumenthal. Sept. 1934.

No. 56. "Nitrifikatsia V Lessnykh Pochvakh V Zavissimosti Ot Sostava Nasjdenia, Rubki I Ognevoi Ochistka Lessosek." (Nitration of Forest Soils with Reference to the Composition of the Stands, Cutting and Fire). By N. N. Sushkina. From "Izvestia Akademii Naouk U.S.S.R. (Bulletin of the U.S.S.R. Academy of Sciences), 1933, pp. 111-159. Translated from the Russian by Dr. C. P. de Blumenthal, October 29, 1934.

No. 28. Influence Du Pasturage Sur L'Ecoulement Des Eaux Et L'Erosion (Influence of Pasture on Water and Erosion) By Hans Burger. From Journal Forestier Suisse. Vol. 82, 1932. Translated from the French by A. H. Krappe, September 6, 1934.

No. 31 Landbautechnische Maßnahmen in Agrarmeteorologischer Betrachtung (Technical Agricultural Measures from the Viewpoint of Agricultural Meteorology) By Dr. P. Lehmann, From Forstschritte Der Landwirtschaft, 1930. Translated from the German by Albin Meier, July, 1934.

